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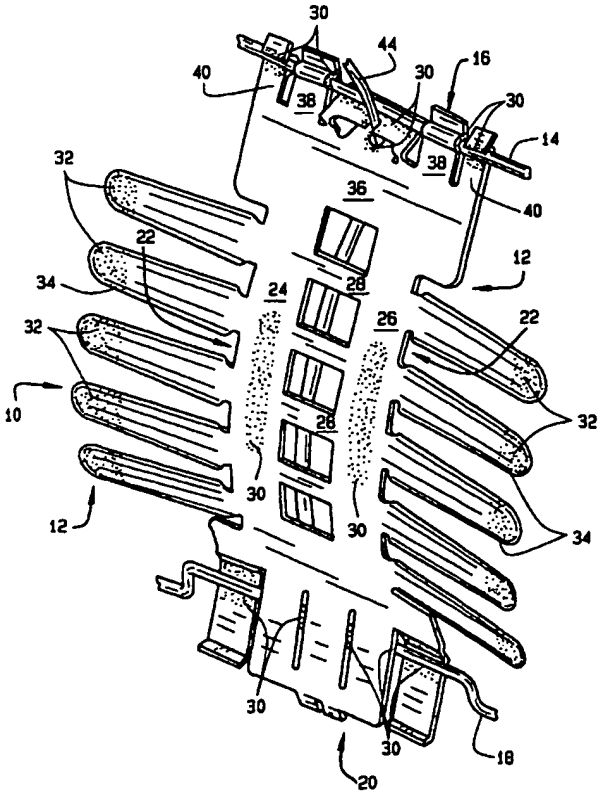
[Continued on next page]

(54) Title: IMPROVED VARIABLE APEX BACK SUPPORT

(57) Abstract: A flexible back support for use in seats such as automobile seats or office chairs.



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Improved Variable Apex Back Support

Field of the Invention

The present invention relates to back supports and more particularly to back supports used in seatbacks.

Background of the Invention

A variety of seatback back support devices provide added support and comfort to a person's back. These devices are especially common in vehicle seats or office chairs as lumbar supports. Examples of such devices are described in U.S. Patent Nos. 5,518,294, 6,036,265; 6,254,187; 6,227,618; 6,158,300; 6,152,532; 6,050,641; 6,036,265; 6,007,151; 5,816,653; 5,681,005; and 5,609,394, the teachings of which are hereby expressly incorporated by reference herein. It would be attractive to reduce manufacturing costs associated with such devices while still preserving the many advantages derived by the general structure and operation of such devices.

Summary of the Invention

In its most general terms, this invention provides a flexible back support member. The support member preferably has a central body portion with a longitudinal axis and opposite ends at each end of the axis. A number of support fingers extend outwardly from the central body portion in a generally horizontal direction. A means for arching the support member is attached to the support member to arch the support member outwardly to support a person's back.

In one embodiment, the support member has a first end portion and a second end portion and includes an intermediate central body portion that is fabricated from a first material, which is preferably flexible. A seat attachment portion is coupled to the central body portion and is made of a second material, which is preferably a molded plastic. In one preferred approach, the attachment portion attaches the support member to a seat back at only one end portion (e.g., as a cantilever). In another preferred approach, the attachment portion attaches the support member to the seat back at both end portions.

In another embodiment, the support member is attached to a seat by connection of one of its end portions to a seat base, and preferably to a frame of the seat base. In yet another

FIG. 11 illustrates another alternative embodiment in which support members are associated with a seat covering.

Detailed Description of the Invention

The subject of the invention pertains to improvements to art-disclosed back support devices and associated components, such as those described in U.S. Patent 5,518,294, 6,036,265; 6,254,187; 6,227,618; 6,158,300; 6,152,532; 6,050,641; 6,036,265; 6,007,151; 5,816,653; 5,681,005; and 5,609,394, all of which are hereby incorporated by reference for all purposes. FIG. 1 is a front perspective view of one preferred embodiment 10 of a back support designed in accordance with this invention. A support member 12 is mounted in a conventional seatback upon a first bar 14 (e.g., a wire or like member, which is generally vertically or horizontally oriented) at a first longitudinal end 16 of the support member 12. An optional second bar 18 is positioned near the second longitudinal end 20 of single-piece support member 12 such that the mounting portion near the second longitudinal end 20 provides a pivotal and movable mount upon or about bar 18. In the embodiment depicted in Fig. 1, Bars 14 and 18 are preferably horizontally disposed within a seatback frame as generally shown in FIG. 2. The details of the mounting and movement of the single-piece support member 12 upon bars 14 and 18 are provided in U.S. Patent 5,5~I 8,294, which is hereby incorporated by reference for all purposes.

Support member 12 includes a central body 22 that may further include longitudinal strips 24 and 26. Transverse strips 28 may also be provided between longitudinal strips 24 and 26 to provide greater comfort to a user and to provide more integrity and stability to support member 12. In one embodiment the support member is a single piece. In another embodiment, the support member 12 is preferably formed of a metal, such as a resilient sheet of a metal, and more preferably a stamping of a spring steel, such as an alloy metal known as Martinsite®. The lightweight and durable nature of support member 12 may be further enhanced by providing transverse strips 28 between longitudinal strips 24 and 26 rather than providing a solid member as central body 22. As discussed in further detail, rather than powder coating or otherwise coating the entire support member 12 (which will typically be a stamping), or the selective use of grommets, improved results are possible by selectively treating the stamping with a coating 30 to impart a protective surface, a low friction surface or both over only a portion of the member 12.

Extending outward from central body 22 are support fingers 32. Support fingers 32

ultra high molecular weight polyethylene (UHMWPE), ultrahigh density polyethylene, or the low friction materials disclosed elsewhere herein) with a suitable adhesive (e.g., an acrylic pressure sensitive adhesive). The tape is applied to the member at the areas that are in contact with the seat back wire or where there is contemplated to be sliding contact between two parts under pressure. As mentioned a number of materials suitably would function for the intended purpose described above. In general, the materials will exhibit a relatively high sliding abrasion resistance, a relatively high notched impact resistance, a relatively low coefficient of friction for on-stick, self lubricated surfaces, relatively good toughness and ductility from -452°F to +194°F, relatively high noise reduction and shock absorption, and relatively good dimensional stability.

In another embodiment, in lieu of or in combination with a tape, a lubricant (e.g., a grease or an oil) is employed over at least a portion of the member. By way of illustration, one suitable lubricant is or has the characteristics of Krytox ®oil (available from DuPont). Such characteristics are summarized in Table A. For example, P.F.P.E. (k) (Krytox) oil with a viscosity index of about 124 and a useful temperature range of about -60° F to +355° F would provide the necessary lubricity to pass our screening.

In yet another illustrative embodiment, a laminated tape is employed having performance characteristics of the tapes disclosed in Table B. For example a plastic metal foil tape might be employed, having an adhesive for bonding on one of its surfaces. By way of illustration, a tape may be used having on the order of about .002 inch thick metal (e.g. aluminum), which has a pressure sensitive adhesive on one surface, and a plastic (e.g., PTFE or Teflon®) layer on the order of about .001 inch thick on the other metal surface. It is believed that this provides sufficient lubricity and toughness to withstand the sliding contact with the seat back wire. Of course, as mentioned above, the above techniques can be used in lieu of or in combination with treating the bars. Table C illustrates a range of characteristics for suitable UHMWPE materials.

FIG. 2 illustrates an alternative support member 42 for mounting on vertically oriented bars, for which the present invention may have like utility. In this regard, the inventive aspects described herein find utility with support members of the type disclosed in other seat back devices including but not limited to those described in U.S. Patent Nos. 6,158,300 (Klingler); 6,050,641 (Benson); 6,152,532 (Cosentino); 6,036,265 (Cosentino); 6,007,151 (Benson); 5, 816,653 (Benson), the teachings of which are hereby expressly

might have plastic fingers 108, with metal elsewhere (e.g., as a metal spine 110), or vice versa. The plastic fingers might be insert molded onto the metal spine or attached in a subsequent operation, e.g., by placing over metal fingers (or protrusions for receiving the plastic fingers), by a coating process, or the like.

In a preferred approach, the central body portion is a metal, such as a sheet spring metal, and the attachment portion is made of a molded plastic. In this manner, advantageously, the attachment portion may be provided as a self-lubricating material, or a material otherwise having a relatively low coefficient of friction. In turn, this permits for the elimination of the need for low friction sleeves or applying lubrication to contact surfaces, such as where the attachment portion is to move along guide wires in the seat back. Also, it is possible to fabricate intricately shaped attachment portion structures, e.g. including integrated sliding surfaces, and structures that permit for the performance of multiple functions within the seat. For instance, an attachment portion might have molded cable or wire guides for routing of cables, wires, conduits or the like within. It might include frames or supports for actuators, controls, electronics, or other components packaged within the seat. Likewise, fingers or other structure in the support member may be adapted for performing multiple functions, such as affording heating or cooling paths, or receiving suitable piezoelectric devices or other electromagnetic devices for providing a vibration source.

It is contemplated that the support member might have sheet metal in face to face contact with some or all of at least one surface of the plastic attachment portions. Alternatively, the metal portion of the support member might adjoin the plastic attachment portions at the respective ends thereof. Combinations of the two might also be employed.

In one embodiment, as shown in FIG. 5, a molded plastic, stamped metal or other suitable fabricated material is configured for defining a cantilever support member 112 including a central body portion 114, support fingers 116 or other support structure. The support member, in turn, is adapted for attachment to a seat, either to a frame member in the seat back (not shown), or to a base 118 of a seat, e.g., to a member inserted in the base, to a seat pan, a seat cushion frame, to a seat track attachment, or otherwise. Optionally, for an embodiment as shown in FIG. 5, the support member is hinged for pivotal rotation along with an adjustable seat back.

Using this type of approach, or any of the above approaches in which a molded plastic component is fabricated as part of the support member, it again is possible to increase the

manually or motor driven translatable bar, web, molded plastic structure, or the like) is adapted to be translated along a guide frame 148 or other suitable guide surface. For instance the support member 146 might be configured with ends 150, 152 for gripping (e.g., frictionally, clamping, snapping or the like) a nub formed on the frame, as seen from the sectional view of FIG. 9. Or a support member 146' might simply have an end (e.g., the above partially opened end of FIG. 9b or the enclosed end 150' of FIG. 9c) adapted to run along a guide wire or rod 154 as in FIG. 9c. The guide surface on the guide frame might have differing profiles or thicknesses that vary along the length for directing the support member. To help secure the support member along the guide surface, the system may include notches or cut outs on the guide surface, the support member or both, for a ratchet and pawl locking adjustment. It may likewise have a screw down attachment, such as for clamping, employ locking pins, or the like.

The function of the adjustable support fingers can also be re-located elsewhere within the seat, such to the upholstery, the padding, suitable webbing, or the like, either in, on or adjacent the front of the seat, the back of the seat, or both. In another embodiment (shown in FIG. 10), a plurality of individually tensionable webs, straps or wires 156 are disposed across a frame 158. When tension is applied to one of the webs 156, it becomes tight and applies increased local pressure toward the back of a user.

FIG. 11 illustrates another embodiment in which the support finger function is re-located to the upholstery, either on an interior or exterior surface. For instance, an upholstery layer 160 might have padded generally horizontally disposed ribs 162 or other horizontally thickened sections. A membrane 164 or wall may be attached thereto or otherwise disposed adjacent to the ribs for providing a surface against which a translatable bar or roller 166, tensionable web or the like may contact for selectively imparting rigidity to certain locations within the seat back. The ribs (which may be rigid insert of thin dimension, a foam of thicker dimension or some other like structure) can be located on a front or rear surface of the upholstery.

The embodiments of the present invention offer many unique advantages relative to existing systems. For example it is contemplated that the embodiments of FIGS. 9-11 as well as the others disclosed are employed in seat backs that are less than 10 cm thick, more preferably less than 8 cm thick, and still more preferably less than 6 cm thick. It is also contemplated that these embodiments are employed in seat backs that are substantially free of

Typical Properties of Krytox® General Purpose Oil and Greases[1]

GPL Oil Grades	100	101	102	103	104	105	106	107
GPL Standard Grease Grades	200	201	202	203	204	205	206	207
GPL Extreme Pressure Grease Gr.	210	211	212	--	214	215	216	217
GPL Anti Corrosion Grease Gr	220	221	222	223	224	225	225	227
ISO Grade of Oil[2]	5	7	15	32	68	150	220	460
Estimated Useful Range[3]								
°C	<-70/66	<-70/104	-63/132	-60/154	-51/179	-38/204	-36/260	-30/288
°F	<-94/150	<-94/220	-81/270	-76/310	-60/355	-33/400	-33/500	-22/550
Oil Viscosity, cST	ASTM D445							
20°C (68°F)	7	15	36	80	180	550	810	1600
40°C (104°F)	4	8	15	30	60	160	240	440
100°C (212°F)	--	2	3	5	9	18	25	42
204°C (400°F)	--	--	--	--	--	3	3.9	6
260°C (500°F)	--	--	--	--	--	--	2.1	3
Oil Viscosity Index D2270	--	--	59	121	124	134	134	144
Oil Pour Point D97								
°C	<-70	<-70	-63	-60	-51	-36	-36	-30
°F	<-94	<-94	-81	-76	-60	-33	-33	-22
Oil Density, g/ml								
0°C (32°F)	1.87	1.89	1.91	1.92	1.93	1.94	1.95	1.95
100°C (212°F)	1.67	1.70	1.72	1.74	1.75	1.76	1.77	1.78
Maxmum Oil Volatility % In 22 hrs D972(Modified)								
@66°C (150°F)	11	2	2	1	1	1	<1	--
@121°C (250°F)	87	35	20	7	3	2	1	--
@204°C (400°F)	--	--	--	--	--	10	<5	<1
Oil Separation From Grease FTMS 791B 321.1								
Wt Loss, %/30 hrs								
@99°C (210°F)	18	9	7	5	4	4	3	3
@204°C (400°F)	--	--	--	--	--	--	11	10
Oil, 4-Ball Wear Test (20 kg/107°C) ASTM D4172 (225°F)/1200 rpm/60 min								
Wesr. Scar. mm (±0.01)[4]	0.4	0.4	0.4	0.3	0.4	0.3	0.3	0.4
Friction Coefficient (±0.003)[4]	0.08	0.07	0.07	0.08	0.07	0.07	0.08	0.08
Oil, Falex Pin/V-Block Load Carrying ASTM D3233								
Ability, Max Load, lbs. (gauge)	1375	1400	1250	1555	1450	>4500	>4500	>4500
Torque at Max Load, in-lb	30	31	32	35	32	56	65	65

[1] This table gives typical properties (not specifications) based on historical production performance. Viscosity may vary within ±10%. DuPont does not make any express or implied warranty that these products will continue to have these typical properties.

[2] Approximate

[3] Based on pour point where evaporation is approximately 10%

[4] Average standard derivation.

TABLE A

UHMW TAPE

	150-3 150-3L	150-5 150-5L	150-10 150-10L
PRODUCT:		Ultra high molecular weight polyethylene film with an aggressive pressure sensitive adhesive. 50DK silicone release liner available.	
APPLICATIONS:		UHMW has low coefficient of friction, therefore offers excellent abrasion resistance. Perfect for sound dampening applications in the appliance and transportation industries and for conveyance applications where a slick, wear resistant surface is needed. Available in both logs and slit rolls.	

PROPERTY	VALUE 150-3	150-5	150-10		TEST METHOD
Film Thickness:	0.003"	0.005"	0.010"	(+/- 10%)	ASTM-D-3652
Adhesive Thickness:	0.0018"	0.0018"	0.0018"	(+/- 10%)	ASTM-D-3652
Total Thickness:	0.0048"	0.0068"	0.0118"	(+/- 10%)	ASTM-D-3652
Liner Thickness:	0.0032"	0.0032"	0.0032"	(+/- 10%)	ASTM-D-3652
Adhesion to Steel:	35 oz./inch	40 oz./inch	28 oz./inch		ASTM-D-1000 (15 min. dwell)
Breaking Strength:	18#	30#	60#	(lbs/inch of width)	ASTM-D-882
Enlongation:	270%	300%	450%		ASTM-D-882
Taber Abrasion:	<2.0 mg	<2.0 mg	<2.0 mg	(mg mass loss)	SAE-J-1847
Dry Dynamic Coefficient of Friction:	0.11-0.25	0.11-0.25	0.11-0.25		ASTM-D-1894

Shelf Life: 1 year when stored under conditions of 70 degrees F. (21 degrees C.) and 50% R.H.

P/N:				
	Self wound:	6893	6903	6904
	linered:	6997	6998	6999

date 1/31/95

TABLE C

4. An automotive vehicle seat, comprising:

a base member adapted for attachment to a floor of an automotive vehicle;

a seatback member attached to one end of said base member;

a seat cover disposed over said seatback member and having a plurality of horizontally disposed ribs on one of its surfaces;

a guide assembly associated with said seat back member;

a rigid member translatable along said guide assembly; and means, attached to said support member, for translating said rigid member to selectively support a user's back.

5. A seat comprising:

a base member;

a seatback member within a seatback attached to one end of said base member;

a flexible support member having two longitudinally spaced ends, one of which is cantilever mounted within said seatback and means, attached to said support member, for longitudinally subtending said support member, whereby said support member arches outwardly to support a user's back.

6. A seat comprising:

a base member;

a seatback member attached to one end of said base member;

a support member having a longitudinal axis and two longitudinally spaced ends, and means, attached to said support member, for subtending said support member, whereby said support member arches outwardly to support a user's back; wherein said means includes an actuator having a longitudinal axis that is disposed generally in axial alignment relative to said longitudinal axis of said support member.

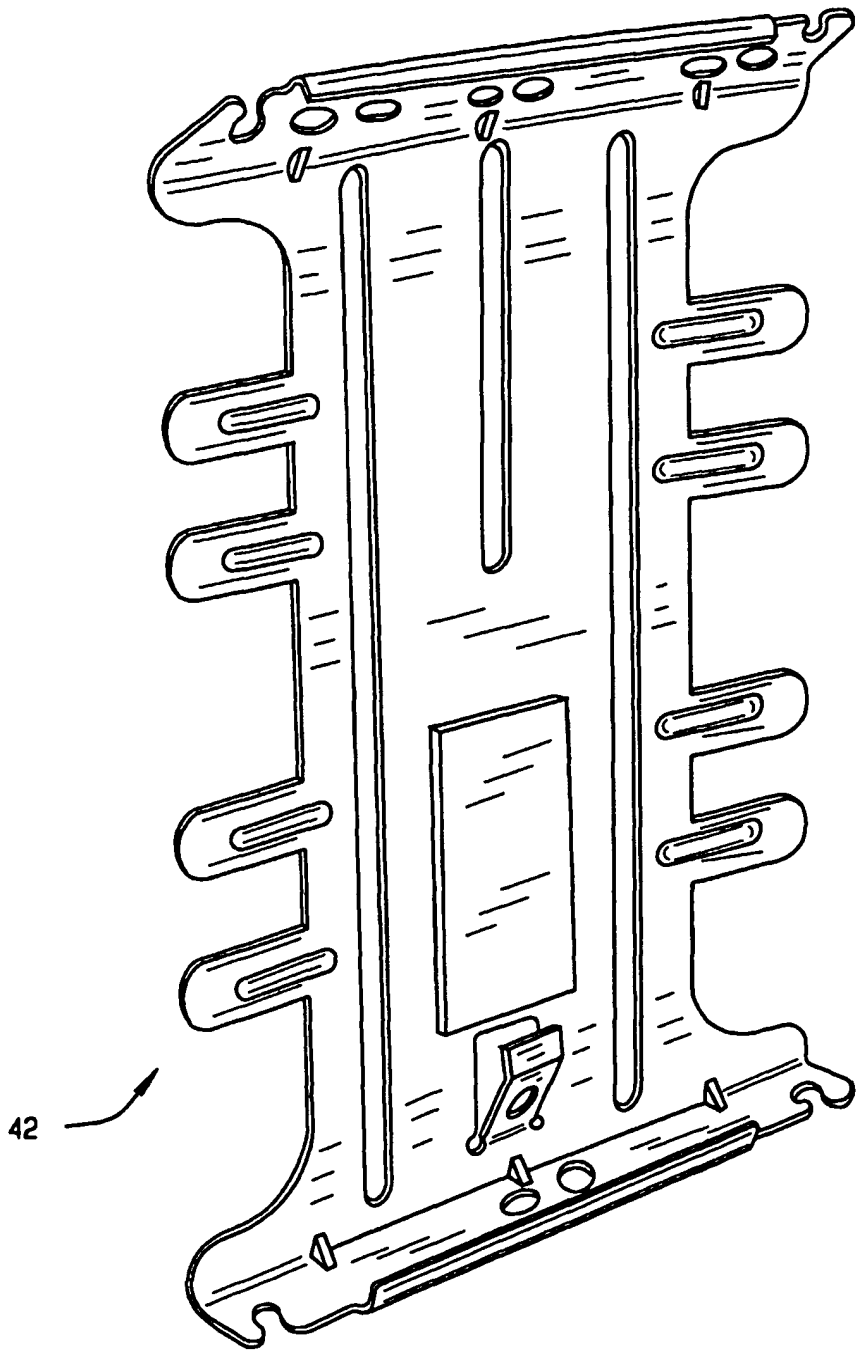

FIG. 2

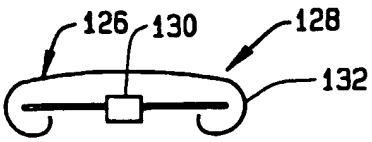

FIG. 7A

FIG. 7B

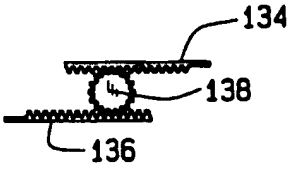

FIG. 7C

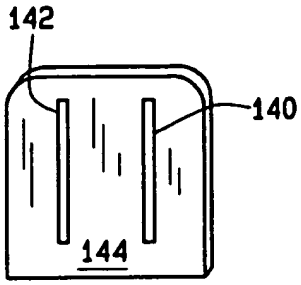

FIG. 8

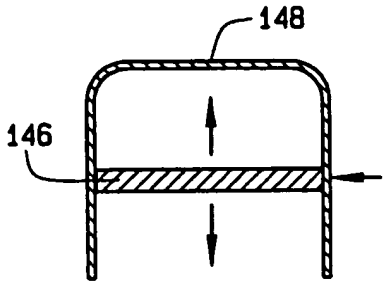

FIG. 9A

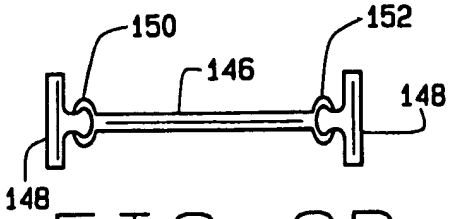

FIG. 9B

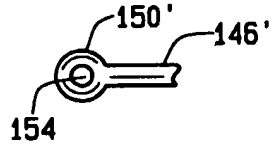

FIG. 9C

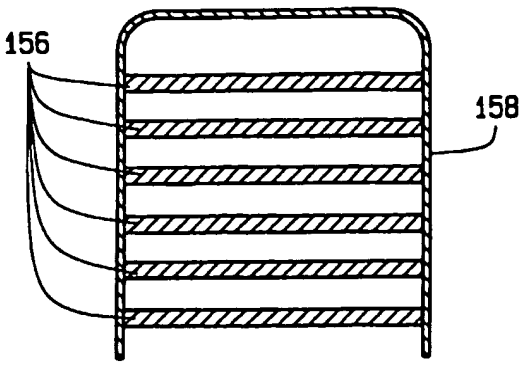

FIG. 10

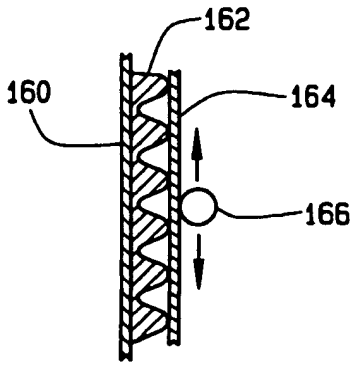

FIG. 11

ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/26275

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 227 618 B1 (PRENDERGAST WILLIAM M ET AL) 8 May 2001 (2001-05-08) cited in the application figure 10	6